DEER

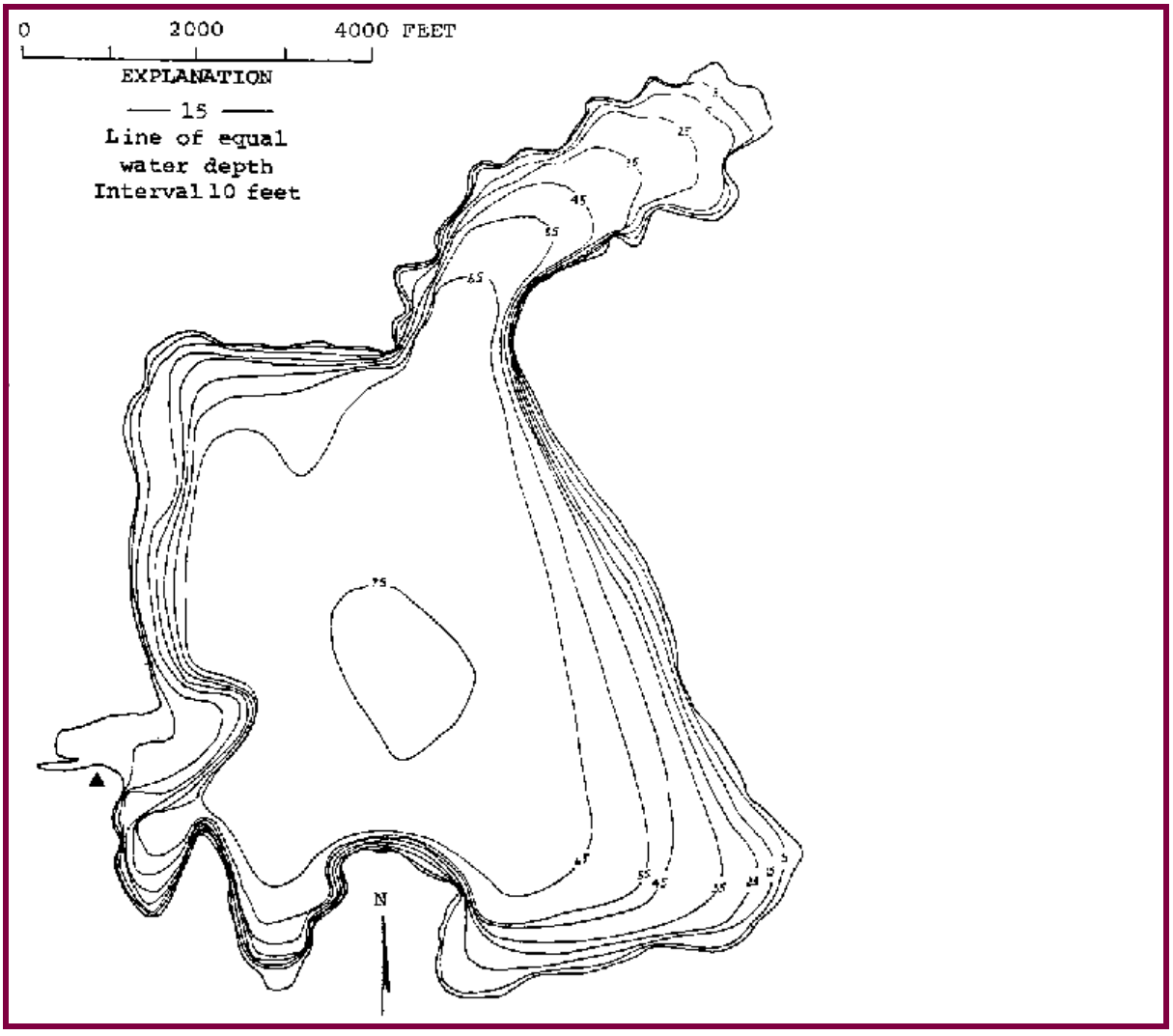
STEVENS County

Lake ID: DEEST2

Ecoregion: 8

Deer Lake is located approximately 25 miles northwest of Spokane, just east of Highway 395.

Area (acres)	*Maximum Depth (ft)*	*Mean Depth (ft)*	*Drainage (sq mi)*	
1110	75	52	18	
Volume (ac-ft)	***Shoreline (miles)***	***Altitude (ft abv msl)***	***Latitude***	***Longitude***
57000	8.62	2474	48 06 28.	117 36 18.



Station Information

DEEST2

Primary Station	Station # 1	latitude: 48 06 25.0	longitude: 117 35 24.0
	Description: At the deep spot.		
Secondary Station	Station # 2	latitude:	longitude:
	Description: Near the end of the arm at the north end of the lake.		

Trophic State Assessment for 1999

DEER

Analyst: MAGGIE BELL-MCKINNON

TSI_Secchi:	[a]	29
TSI_Phos:		48
TSI_Chl:		32
Narrative TSI:	[b]	OM

Summary Comments:

The general water clarity of Deer Lake was excellent in 1999. The Secchi depth readings ranged from 7.2 meters (23.6 feet) to 9.9 meters (32.4 feet) with a mean Secchi depth of 8.7 meters (28.7 feet). For comparison, in 1992 (the most recent year Secchi data was collected) the mean Secchi depth was 6.9 meters (22.6 feet).

No geese but numerous other waterfowl were observed on the lake by the volunteer monitor during his sampling visits made between June and September.

The chemistry data collected for Deer Lake showed low phosphorus levels in July but high levels the rest of the summer. Values ranged from 7.8 ug/L to 26.3 ug/L in the epilimnion and hypolimnetic readings of 21.3 ug/L to 34.8 ug/L. The chlorophyll levels showed low algae densities in the lake. However the phosphorus data indicate a level of productivity where the potential exists for algae growth to be heavy and long lasting.

Ecology staff made four site visits in 1999. Thermal stratification and low dissolved oxygen levels in the hypolimnion were noted during each of these visits.

Ecology staff conducted an aquatic plant survey on 7/27/1999. A wide variety of aquatic plants occur in the lake with the dominant species being Potamogeton amplifolius (large-leaf pondweed). The only nonnative species observed was Phalaris arundinacia (reed canarygrass).

Based on the Secchi depth data, and the phosphorus and chlorophyll levels, Deer Lake is classified as oligomesotrophic.

The following is an assessment written by Ecology staff, Sarah O'Neal, to determine the phosphorus criterion for

Deer Lake:

Deer Lake is a large, deep lake which displayed many oligotrophic characteristics. Exceptional water clarity in the lake and low chlorophyll-a concentrations indicated little photosynthetic activity. Plants, mostly submerged, grew at moderate densities. No noxious weeds occur in the lake, though milfoil was present in nearby Loon Lake. Algal blooms occurred occasionally, but were not excessive. However, surprisingly high total phosphorus concentrations indicated a high mesotrophic state. Nitrogen limitation may explain why the mean Secchi depth and chlorophyll concentrations were lower than mean total phosphorus concentrations would indicate. Several potential nutrient sources existed in and around the lake. Approximately 600 homes, 450 of which were occupied year round, densely surround the shoreline. These homes were all on individual septic tanks until a sewer was built in 1992. Sparse vegetation around the shoreline resulted largely from development, with either buildings or lawns often extending up to the water's edge. This allowed runoff from the surrounding watershed to more easily enter the lake, including fertilizers used for lawn maintenance. Furthermore, cattle grazed up to and in the inlet to Deer Lake. Fencing cattle out of the lake, which occurred for the first time in 1999, may improve nutrient levels over time. Finally, logging occurred within the surrounding watershed. As well as high total phosphorus levels, one sample taken in August near the boat launch indicated a high fecal coliform concentration. The source of contamination is unknown, but possible sources include stormwater runoff, goose and animal access, and swimmers.

Questionnaire respondents indicated relaxing as their primary activity on the lake. Other uses included fishing, swimming, skiing, and boating. Questionnaire respondents indicated water quality, scenic views, fishing quality, and swimming opportunities added to the enjoyment of the lake and facilitated relaxing. WDFW managed the lake for eastern brook trout, rainbow trout, mackinaw (lake trout), and kokanee. They planted approximately 20,000 rainbow trout annually at a catchable size. Two-hundred-fifty-thousand small kokanee fry were planted between 1998 and 1999. Generally, kokanee exhibited little positive return. Kokanee that survived grew to a healthy size despite high mortality. In addition to the hatchery fish, there were two net pens on the lake. One contained rainbow trout and the other contained eastern brook trout. They each raised and released about 15,000 fish annually. Other species in the lake included yellow perch, sunfish, bullhead, large- and smallmouth bass, black crappie, and pumpkinseed. Zooplankton were exceptionally small considering the diversity of the fishery, which may indicate an ineffective amount of piscivores to control planktivore density.

Three of four earlier Ecology water quality surveys of the lake, from 1989-1992, indicated an oligotrophic state, with low total phosphorous levels ranging from 7 to 17 ug/L. Due to this, the dense development around the lake, and watershed uses, the oligomesotrophic state of the lake may not be natural. Consequently, we recommend an interim total phosphorus criterion of 20 ug/L, the action value for Northern Rockies lower mesotrophic lakes, pending a more thorough study, including a nutrient budget

analysis. Phosphorus concentrations exceeded this criterion in 1999. Future studies will likely recommend lowering this criterion. Due to the limitations of the sampling conducted during this study, it is difficult to determine whether nitrogen is also limiting to the system. Future studies may propose a nitrogen criterion.

Mean Secchi = 8.7m; Mean TP = 21.4 ug/L; Mean Chl = 1.2 ug/L

[a] TSI Qualifiers: B or W-Secchi Disk hit bottow or entered weeds; J-Estimate; N-Fewer than the required number of samples

[b] E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

Chemistry Data

DEER

Date	Time	Strata	Tot P (ug/L	Tot N (mg/L)	TN:TP	Chloro-phyll (ug/L)	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Calcium (ug/L)	Turbidity (NTU)
Station 0										
6/14/1999		L					1 U			
		L					1			
7/12/1999		L					1 U			
		L					33			
8/9/1999		L					5			
		L					160			
9/13/1999		L					3			
		L					1 U			
Station 1										
6/14/1999		E	23.5	.25	11	.97		32.5	8920	.5
		H	26.7	.237	9					
7/12/1999		E	7.77	.301	39	1.71				.5
		H	21.3	.28	13					
8/9/1999		E	22.8	.288	13	1.1				.6
		H	21.7	.261	12					
9/13/1999		E	26.3	.253	10	1.2				.5 U
		H	34.8	.231	7					

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than, G=Greater than.

Watershed Survey

DEER

Survey Date: 9/13/1999

Land Uses (1 = Primary, 2 = Secondary, etc.)

- [3] **Agriculture(commercial, not hobby)**
- [ ] **Commercial, Industrial**
- [ ] **Major transportation**
- [1] **Residential**
- [2] **Park, forest or natural**

Impervious surfaces (Roads and parking area): No Curbs

Observations (check mark denotes presence)

BMP's ☐

Odors ☐

Cattle ☐ **Ducks** ☐ **Geese** ☐

Cattle at north end (inlet) have been removed.

Fertilizers and weed killers appear to be used in residential or agriculture area ☑

Mostly unfertilized. "Wanakawin" (?) Associate on NE side of lake fertilizes.

Buffer zones around streams and wetlands ☑

SCS bought inlet area, cleaned up, planted riparian and other areas, installed log weirs. 1999 is first year without cattle.

Irrigation ☐

Survey Id: 1

Habitat Survey Summary Report

DEER

Data are averages of ***10*** **Stations Surveyed** **Date of Visit:** 7/27/1999

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	2.1	**Number of stations with canopy:**	8
Understory Avg:	2.4	**Number of stations with understory:**	5

Percent Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	**trees > 0.3 m DBH**	1.6
	trees< 0.3 m DBH	0.5
Understory:	**woody shrubs saplings**	0.8
	tall herbs, forbs grasses	0.2
Ground Cover:	**woody shrubs seedlings**	0.7
	herbs, forbs, grasses	2.1
	standing water or inundated veg	0.0
	barren or buildings	3.3
Substrate Type (within shoreline plot):	**bedrock**	0.0
	boulders	0.2
	cobble/gravel	2.0
	loose sand	0.4
	other fine soil/sediment	0.0
	vegetated	1.0

	other	1.2
Bank Features:	**angle (O:<30; 1: 30-75; 2:nr vertical)**	1.3
	vertical dist (M from wtrln to high wt):	0.4
	horiz. dist. (M from wtrln to high wt):	0.4

Human Influence (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	1.9
commercial	0.1
park facilities	0.0
docks/boats	1.8
walls, dikes, or revetments	1.1
litter, trash dump, or landfill	0.2
roads or railroad	0.3
row crops	0.0
pasture or hayfield	0.0
orchard	0.0
lawn	0.6
other	0.0

Physical Habitat Characteristics

station depth (m; at 10 m from shore)	2.8

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0
boulders	0.4
cobble	1.0
gravel	1.4
sand	1.2
silt	2.1
woody debris	0.3

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	1.8
emergent	0.2
floating	0.3
total weed cover	1.9
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-1.0

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	1.6
snags	0.0
brush or woody debris	0.1
inundated live trees	0.0
overhanging vegetation	0.1

rock ledges or sharp dropoffs	0.3
boulders	0.1
human structures	1.1

Questionnaire

DEER

Results compiled from 5 **Surveys.** **Average time (years) respondents spent on lake:** 14.80

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:	0.5	View:	1.0	Distance to Lake:	0.2
Public Access:	0.2	Swim Beach:	0.8	Canada Geese:	0.0
Water Clarity:	1.0	Water Qual. for Swim:	0.8		
Fishing Quality:	0.8	Aquatic Plants:	0.2		

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today? **4.2**

Which would you rather have, 1 or 2?

1) Better fishing and more natural habitat, or 2) clearer water?	1.8
1) Better fishing and more natural habitat, or 2) fewer aquatic plants?	1.0
1) Clearer water, or 2) fewer aquatic plants?	1.0

How important is each of the following characteristics to you (1 = very undesirable, 5= very desirable):

Restricted Watercraft:	2.8	Good Warmwtr Fishing:	4.0	Natural Scenery:	4.4
Plant Growth:	3.0	Good Swimming:	4.8	Public Beach:	2.8
Natural Shoreline:	3.2	Less Algae:	4.2	Canada Geese:	3.0
No Odors:	4.6	Public Access:	3.0		
Good Coldwtr Fishing:	4.0	Clear Water:	4.6		

Tabulated Results

Survey ID	Date	Residency		Rent or Own	Primary Activity*	Water Clarity: Purchase Factor?	Water Clarity: Has it Changed?	Water Clarity: When?
136	6/21/1999	Resident	Permanent	Rent	Operate a resort	☑	Better	
162	6/22/1999	Resident	Permanent	Rent	6	☑	Better	1985
174	6/28/1999	Resident	Seasonal	Rent	10	☑	Unknown	
189	6/19/1999	Resident	Seasonal	Rent	10	☑	Worse	1985
	Paved roads keep down dust							
206	7/3/1999	Visitor			2	☐	Unknown	

* 1=canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

DEEST2

Date 6/14/1999 Station: 1 Sample ID 62

Less than 0.5 mL sampled.

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	0.29

Date 8/9/1999 Station: 1
Sample ID 45

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	0.36

Aquatic Plant Data

DEER

Sampler: Parsons, O'Neal Survey Date: 7/27/1999

Max depth of growth (M): 7.5

Comments Sunny, calm. Large non-native snails, many ducks with young. Houses right along water's edge along much of shore. Several private launches and small marinas. Did habitat survey.

SPECIES LIST

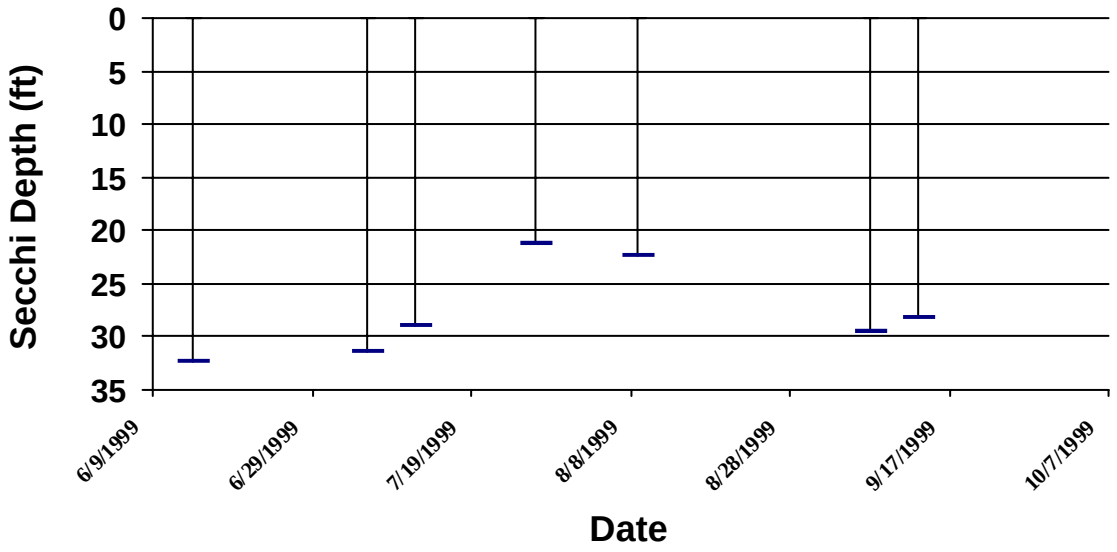
Scientific Name	Common Name	Dist [a]	Comments
Brasenia schreberi	watershield	3	
Ceratophyllum demersum	Coontail; hornwort	2	
Chara sp.	muskwort	2	
Elodea canadensis	common elodea	2	
Heteranthera dubia	water star-grass	2	
Juncus sp.	rush	2	
Lemna minor	duckweed	1	
Megalodonta beckii	water marigold	3	
Myriophyllum sibiricum	northern watermilfoil	2	
Najas flexilis	common naiad	2	
Nitella sp.	stonewort	1	
Nuphar polysepala	spatter-dock, yellow water-lily	2	
Phalaris arundinacia	reed canarygrass	2	
Polygonum amphibium	water smartweed	1	1 patch north of launch in cove
Potamogeton amplifolius	large-leaf pondweed	4	
Potamogeton epihydrus	ribbonleaf pondweed	1	may be a hybrid
Potamogeton gramineus	grass-leaved pondweed	2	
Potamogeton pectinatus	sago pondweed	2	
Potamogeton robbinsii	fern leaf pondweed	3	
Potamogeton sp (thin leaved)	thin leaved pondweed	2	
Potamogeton zosteriformis	eel-grass pondweed	2	

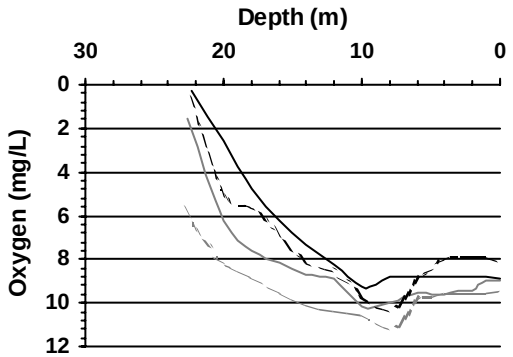
Ranunculus aquatilis	water-buttercup	2	mostly in shallows
Scirpus sp.	bulrush	2	bulrush
Typha latifolia	common cat-tail	2	
Utricularia vulgaris	common bladderwort	1	
Vallisneria americana	water celery	3	

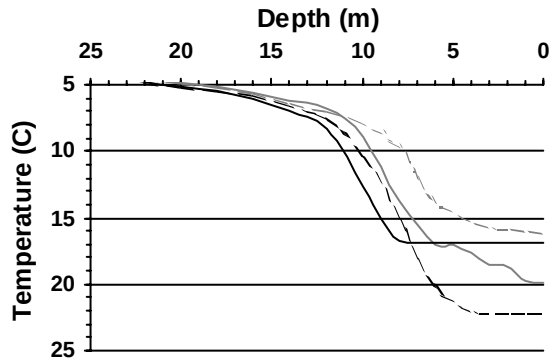
[a] 0 - value not recorded (plant may not be submersed)
1 - few plants in only 1 or a few locations
2 - few plants, but with a wide patchy distribution
3 - plants in large patches, codominant with other plants
4 - plants in nearly monospecific patches, dominant
5 - thick growth covering substrate to exclusion of other species

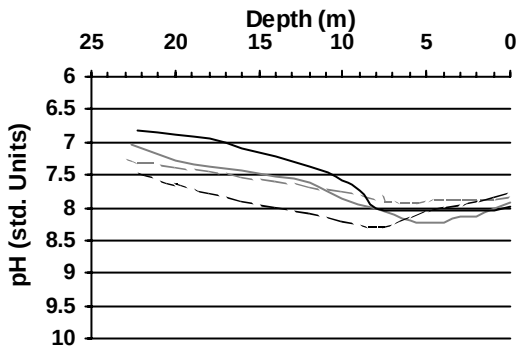
Secchi Depth and Profile Graphics

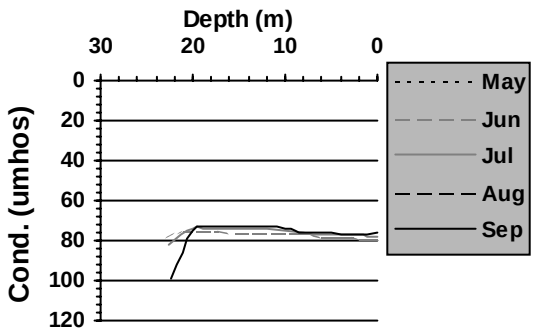
Station: 1 DEEST2











Secchi Data and Field Observations

DEER

Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
Station 1													
6/14/1999		17	32.4	6	10	1	1	5	5	0	22	10	0
	Sampler: PHILLIPS			Remarks: Dissolved oxygen measurement qualified as an estimate due to calibration failing QA/QC requirements									
7/6/1999		18.5	31.5	2	0	1	5	5	5	0	3	3	1
	Sampler: PHILLIPS			Remarks: Did not use a view tube. Some Fourth of July fireworks debris.									
7/12/1999			28.9	6	0	1	1	5	5	0	30	8	0
	Sampler: PHILLIPS			Remarks: Dissolved oxygen measurement qualified as an estimate due to calibration failing QA/QC requirements.									
7/27/1999		22	25	2	0	1	1	5	5	0		2	2
	Sampler: PHILLIPS			Remarks:									
7/27/1999			21.33										
	Sampler: Parsons			Remarks:									
8/9/1999			22.3	2	0	1	1	5	4	0	30	7	1
	Sampler: PHILLIPS			Remarks: Bottom: 22.4M. Vol. Reports 8-9 year flushing time (source: Soltero, EWU). Dissolved oxygen measurement qualified as an estimate due to calibration failing QA/QC requirements.									
9/7/1999		19	29.5	2	0	2	1	5	5	0	6	3	0
	Sampler: PHILLIPS			Remarks: Did not use a view tube.									
9/13/1999			28.2	2	1	1	1	4	4	0	70	6	1
	Sampler: PHILLIPS			Remarks: Bottom: 22.3M. Waterfowl are mostly seagulls and grebes.									
Station 2													
7/6/1999		18	26.5	2	0	1	1	5	5	0	2	3	0
	Sampler: PHILLIPS			Remarks: Did not use a view tube.									
7/27/1999		21.5	20	2	0	2	1	5	5	0		3	1
	Sampler: PHILLIPS			Remarks: Did not use a view tube. Hot weather.									
9/7/1999		18	27	2	0	2	1	5	5	0	4	1	0
	Sampler: PHILLIPS			Remarks:									